An Endangered Moth in Ohio, With Notes on Other Species of Special Concern (Lepidoptera: Saturniidae, Sphingidae, Notodontidae and Arctiidae)[1]

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ABSTRACT. **Seven families of Lepidoptera comprising 184 moth species in Ohio were evaluated for possible consideration as Endangered, Threatened or Special Concern status in Ohio. Based on extensive review of public and private collections of Ohio Lepidoptera, one species, *Cycnia inopinatus* (Henry Edwards) (Arctiidae) is considered Endangered. Four species: *Hemileuca maia* (Drury) (Saturniidae), *Smerinthus cerisyi* Kirby and *Hemaris gracilis* (Grote & Robinson) (Sphingidae), and *Grammia oithona* (Strecker) (Arctiidae) are of Special Concern. The Status is Unknown for three species: *Sphinx drupiferarum* J. E. Smith and *Lapara bombycoides* Walker (Sphingidae), and *Holomelina nigricans* (Reakirt) (Arctiidae). Eight species are considered to be of Special Interest: *Samia cynthia* (Drury) (Saturniidae), *Sphinx luscitiosa* Clemens, *Aellopos fadus* (Cramer) and *Xylophanes tersa* (L.) (Sphingidae), *Notodonta simplaria* Graef and *Gluphisia lintneri* (Grote) (Notodontidae), *Crambidia pura* Barnes & McDunnough, and *Grammia doris* (Boisduval) (Arctiidae).**

Primary threats to continued survival of these species are loss of suitable habitat and pesticide application for gypsy moth [*Lymantria dispar* (L.)] control. Six of the species are associated with the Oak Openings area of Lucas County, an area undergoing considerable change from housing, commercial and industrial development. Management practices to protect and preserve the Openings should be adopted. Insecticides should not be applied in sensitive areas because of the possible impact on these and other lepidopteran species.

OHIO J. SCI. 90 (1): 33-40, 1990

INTRODUCTION

Shuey et al. (1987) first proposed considering Ohio lepidopteran species as **Endangered**, **Threatened**, and of **Special Concern**. Their list was limited to butterflies. Extensive data for seven families of moths (Apatelodidae, Lasiocampidae, Saturniidae, Sphingidae, Notodontidae, Arctiidae and Lymantriidae) have now been accumulated from public and private collections. The families included in this paper were studied in 1987 pursuant to a contract with the Ohio Department of Natural Resources Division of Wildlife.

Butterflies and moths attract amateur collectors who contributed the majority of data reported here. Thus, the preferences of amateur collectors influence our ability to evaluate the endangered status of moths compared to butterflies. More than 2,500 species of Lepidoptera should be found in Ohio (C.V. Covell pers. comm.). Nearly 93% of Lepidopteran species are moths, yet butterfly collectors outnumber moth collectors nearly two to one. Although there are more species of moths than butterflies, their distributions, habitat and foodplant requirements are not well known. Because many species of moths are small, obscure, and difficult to identify, they are less often included in collections than are butterflies.

Moths can be difficult to collect. The blacklights, sheets, generators or batteries, and other equipment required for collecting moths is cumbersome. The nocturnal habits of most moths create physiological and psychological barriers to amateur collectors because human beings are uncomfortable in the dark, and the enjoyment of being out-of-doors with nature is less evident in the dark hours.

[1]Manuscript received 20 January 1989 and in revised form 8 September 1989 (#89-4).

The Giant Silkworm Moths (Saturniidae), Hawk and Hummingbird Moths (Sphingidae), Tiger Moths, Woolly Bears and Tussock Caterpillars (Arctiidae) attract attention from lay persons as well as lepidopterists because of their larger size and beauty. The relative popularity of these moths among collectors helped to provide sufficient data for evaluating their status as **Endangered**, **Threatened**, **Species of Special Concern**, or **Status Unknown**.

MATERIALS AND METHODS

All public and private lepidopteran collections in Ohio were visited, as well as several other major collections outside Ohio, including the U.S. National Museum (USNM), American Museum of Natural History (AMNH), Carnegie Museum of Natural History (CMNH), and Field Museum of Natural History (FMNH). All data were recorded for transfer to dBase III Plus® commputer files deposited with the ODNR Division of Wildlife and The Ohio Lepidopterists. Additional data have been continually added to both depositories, which is comprised of about 10,000 individual specimen records.

Our descriptive categories, **Endangered**, **Threatened**, **Species of Special Concern**, and **Status Unknown** are adapted from Shuey et al. (1987). An **Endangered** species' survival is in immediate jeopardy because of an identifiable threat. A **Threatened** species is not in immediate danger but an identifiable threat exists. Species of **Special Concern** occupy limited ranges and could become threatened under conditions of continued or increased environmental stress. Species that are very rare, that appear to be undergoing an unexplained decline, that are seldom recorded, or that may be infrequent residents in Ohio are included as **Status Unknown**.

Because less is known about moths than butterflies, the

status of several species did not fit the existing categories. Thus a new category, **Species of Special Interest**, was created to include: a) transients that apparently establish temporary breeding colonies; b) species introduced to the United States which are now resident; c) species with disjunct distributions; and d) species which are very rare or local because Ohio is at the extreme edge of their range (Table 1).

SPECIES ACCOUNTS

Of 184 species surveyed, one species, *Cycnia inopinatus* (Henry Edwards) (Arctiidae) is considered **Endangered**. Four species: *Hemileuca maia* (Drury) (Saturniidae), *Smerinthus cerisyi* Kirby and *Hemaris gracilis* (Grote & Robinson) (Sphingidae), and *Grammia oithona* (Strecker) (Arctiidae) are of **Special Concern**. The **Status is Unknown** for three species: *Sphinx drupiferarum* J. E. Smith

TABLE 1

Summary of status, occurrence, and habitat requirements of critically rare Ohio moths. Status abbreviations: Endang. = ***Endangered****., Spec. Concern =* ***Special Concern****., Unkn. =* ***Status Unknown****., Spec. Int. =* ***Special Interest.*** *Occurrence abbreviations: Ad-Adams Co., As-Ashtabula Co., A-Athens Co., Au-Auglaize Co., C-Clark Co., Cu-Cuyahoga Co., Fa-Fairfield Co., Fr-Franklin Co., Ge-Geauga Co., Gr-Greene Co., Gu-Guernsey Co., Fu-Fulton Co., Ha-Hamilton Co., Hi-Highland Co., Ho-Hocking Co., Ja-Jackson Co., Kn-Knox Co., La-Lawrence Co., Lu-Lucas Co., Ma-Mahoning Co., Mn-Marion Co., Mr-Morgan Co., Mo-Montgomery Co., Ot-Ottawa Co., Ro-Ross Co., Sa-Sandusky Co., Sc-Scioto Co., Se-Seneca Co., Su-Summit Co., Tu-Tuscarawas Co., V-Vinton Co., W-Warren Co., Wy-Wayne Co.*

Species	Status	Historical Occurrence	Present Occurrence	Host Plant	Habitat	Reasons/potentials For Decline	Comments
**Hemileuca maia*	Spec. Concern	Fu, Lu	Lu	*Salix*	Oak Openings	habitat modification habitat succession Gypsy moth control	
Samia cynthia	Spec. Int.	Mo, Tu	?	*Ailanthus*	central city RR yards	habitat modification	may be extirpated
Sphinx luscitiosa	Spec. Int.	Lu	?	*Salix*	forest openings	habitat modification habitat succession Gypsy moth control	
Sphinx drupiferarum	Unkn.	A, Cu, Fr, Gr, Ha, Lu Mo, Mn, Sa, Se, Su, V, Wy	Ge, Gu Lu, Sa	Rosaceae hackberry lilac	forest openings	none identified	
Lapara bombycoides	Unkn.	Tu	?	*Pinus*	pine woods	Gypsy moth control	may be extirpated
Smerinthus cerisyi	Spec. Concern	Lu, Se	Lu	*Salix Populus*	wooded areas openings	habitat modification habitat succession Gypsy moth control	
Aellopos fadus	Spec. Int.	Ma	?	Rubiaceae	none defined	none identified	intermittent resident
Hemaris gracilis	Spec. Concern	Lu	Lu	*Vaccinium*	Oak Openings Oak savanna/ dunes	habitat modification habitat succession	
Xylophanes tersa	Spec. Int.	statewide	statewide	*Spermacoce Pentas Manettia*	none defined	none identified	intermittent resident
Notodonta simplaria	Spec. Int.	As	As	*Populus*	deciduous forest areas	Gypsy moth control	
Gluphisia lintneri	Spec. Int.	As	As	*Populus tremuloides*	deciduous forest areas	Gypsy moth control	
Crambidia pura	Spec. Int.	A	Ad	lichens	?	effect of air pollution on lichens	
Holomelina nigricans	Unkn.	V	V	herbaceous plants	openings in oak forests	Gypsy moth control	
Grammia oithona	Spec. Concern	A, Kn, Ot, Lu, Ad	Lu	herbaceous plants	old fields/ dunes	habitat modification habitat succession	
Grammia doris	Spec. Int.	A	?	herbaceous plants	?	none identified	
Cycnia inopinatus	Endang.	Lu, Ad	Lu	*Asclepias*	old fields/ dunes	habitat modification habitat succession	

* The discussion applies only to the Lucas County population.

and *Lapara bombycoides* Walker (Sphingidae), and *Holomelina nigricans* (Reakirt) (Arctiidae). Eight species are considered to be of **Special Interest**: *Samia cynthia* (Drury) (Saturniidae), *Sphinx luscitiosa* Clemens, *Aellopos fadus* (Cramer) and *Xylophanes tersa* (L.) (Sphingidae), *Notodonta simplaria* Graef and *Gluphisia lintneri* (Grote) (Notodontidae), *Crambidia pura* Barnes & McDunnough, and *Grammia doris* (Boisduval) (Arctiidae).

Endangered

Cycnia inopinatus (Henry Edwards 1882) Arctiidae - Unexpected Cycnia

Historical Occurrence: *Cycnia inopinatus* was recorded from Ohio from 1963 through 1988 by T. W. Carr, G. Firebaugh, and D. J. Wright. Two adults were collected from the Oak Openings area of Lucas County, and one adult was collected in Lynx Prairie in Adams County. Larvae have been reported from the Oak Openings on common milkweed (Firebaugh pers. comm.) and in Michigan, several miles north of the Ohio-Michigan border. Larvae were found 13 August 1963, 7 August 1966, 13 August 1973, and 6 through 10 June 1976. Adults emerged 2, 4 and 7 July 1976. Captive females oviposited 7 July 1976.

Current Status: This species inhabits sand hills and other disturbed sandy soil areas. In Ohio it is found only in two significant habitats, the Oak Openings and Lynx Prairie. The larval hosts are various species of milkweed (*Asclepias* spp.). This species has been collected in Michigan in habitat similar to the Oak Openings and reared in Florida on *Asclepias humistrata* Walter (Sandhill milkweed), a species found in sand hills, dry oak woods and pine barrens (Duncan and Foote 1975). The moth is best found by looking for the larvae (H. D. Baggett pers. comm.).

Potentials for Decline: Remaining open sandy areas in the Oak Openings are limited by development pressures which are converting preferred habitat to home sites, shopping areas, or industrial areas. In addition, fire control allows successional growth to invade and further modify the open sand areas.

Recommendations: The "natural" habitat of the Oak Openings in Lucas County should be protected and manipulated with frequent disturbances favoring early successional habitats with open sandy areas. Prairie management practices at Lynx Prairie should accommodate the habitat requirements of this species. Burning should not interfere with its life cycle.

Species of Special Concern

Hemileuca maia (Drury 1773) Saturniidae - Buck Moth (Lucas County population)

Historical Occurrence: Records from the late 1800s and early 1900s show that the Buck Moth inhabited northwestern to central and southern Ohio, including Auglaize, Seneca, Franklin and Montgomery Counties.

Current Status: In Ohio, *H. maia* is currently restricted to the Oak Openings area of Lucas County and southern regions of the state. Populations in both regions are well established, but exhibit dissimilar ecological preferences. The Lucas County population occurs in typical Buck Moth habitat, i.e. oak barrens, and feeds on willows (*Salix* spp.), while the southern Ohio population inhabits mature oak woods and feeds on *Quercus* spp. In Lucas County, the moths breed in Oak Openings Metropark, Irwin Prairie State Nature Preserve, Lou Campbell State Nature Preserve and other roadside habitats and disturbed areas where willow saplings are abundant. In Lucas County, females have been observed to lay eggs within inches of the ground on small willow shoots, but in southern Ohio females lay eggs on pencil-sized branches more than 20 ft above ground in mature trees, often located along roads, trails or other clearings. Pilate (1882) reported willow as the foodplant in the vicinity of Dayton.

The Lucas County population is apparently part of an upper midwest zone of intergradation between *H. maia,* which has a larval host plant of oak, and *H. nevadensis* Stretch, which has a larval host plant of willow (Ferguson 1971-72). The Lucas County form looks like *H. maia* but the larvae feed on willow. A 1981 rearing experiment found some evidence of genetic isolation because of food plant incompatability between the northwest and southeast Ohio populations. Newly emerged larvae from a single egg mass of a Lucas County female (approximately 150 larvae) were offered black willow and pin oak. About half the larvae accepted oak and the other half accepted willow. Both groups of larvae were offered fresh leaves daily. The larvae were reared in closed containers in a laboratory. Confined to the foodplant originally chosen, the larvae eating willow grew normally, pupated in mid-July and eclosed normal adults in September. Larvae fed oak appeared to grow normally until the third instar, when most stopped growing. Oak-feeding larvae ate with vigor but they failed to increase in size. Only a few molted to the fourth instar, which continued eating but died before pupating.

The northwestern and southern Ohio populations may not be conspecific. The Lucas County population should be preserved to maintain genetic diversity in Ohio.

Potentials for Decline: Remaining "natural" areas in western Lucas County are limited because development pressures are reducing the preferred habitat.

Recommendations: The systematic position of the Lucas County population should be determined. Adults of both populations should be mated and their progeny (if any) reared on both hosts. Remaining "natural" habitat of the Toledo Area Metropolitan Park District, nature preserves and Maumee State Forest may be the only refugia for this population in Ohio. Land management practices that favor the foodplant, create disturbed areas for propagation of willow saplings, and leave openings should be adopted.

Smerinthus cerisyi Kirby 1837 Sphingidae - One-eyed Sphinx

Historical Occurrence: A single record (Henninger 1910) lists this species from Seneca County.

Current Status: One specimen in the J. W. Porter collection is from Seneca County (23 Aug 1956). Carr (pers. comm.) and our research confirm that this species has been "common" in the Lucas County Oak Openings.

Potentials for Decline: The larval hosts most preferred by this species, willows, poplars, plum, and pears (Covell 1984), are found throughout Ohio (Braun 1961). Ohio is at the southern edge of its range in lower elevations. Because of its localized distribution, further habitat degradation could eliminate this species.

Recommendations: Protect "natural" Oak Openings habitat in Lucas County.

Hemaris gracilis (Grote & Robinson 1865) Sphingidae - Slender Clearwing.

Historical Occurrence: Hodges (1971) gives the range from "Nova Scotia to central Florida along the East Coast and west through the New England states to Michigan and perhaps Wisconsin." Ohio is at the southern limit of the range for this species in the Midwest. Ohio records for *Hemaris gracilis* were collected in the Oak Openings, Lucas County: 1) 2 June 1955, H. Price, Ohio State University Collection (OSUC); 2) 9 June 1968, Carr, personal collection. Two other specimens in the OSUC, labeled "Cols. [Ohio]", part of the W. N. Tallant Collection, were collected prior to 1906 when Tallant died. The specific locality of the Tallant specimens is unknown.

Current Status: This species appears to be restricted to the Oak Openings. The two records from that area indicate that a population may exist. It is very similar to the common *H. thysbe* and *H. diffinis,* and confusion with those species could lead collectors to overlook *H. gracilis.*

Potentials for Decline: Although this species is rare over its entire range, it is more frequently collected in habitats similar to the Oak Openings area of Lucas County. Williams (1978) recorded both *Vaccinium vacillans* and *V. corymbosum* as hosts. *Vaccinium vacillans,* which occurs in dry woods (Fernald 1950) and which is common in Lucas County (Braun 1961, Mosley 1928), is the probable foodplant in Ohio. This species' restricted distribution makes it vulnerable to the rapidly changing land uses in western Lucas County.

Recommendations: Management practices that favor the foodplant and leave openings should be adopted.

Grammia oithona (Strecker 1878) Arctiidae - Oithona Tiger Moth

Historical Occurrence: The oldest Ohio records of *G. oithona* are Greer (Knox County) 1940, and Athens (Athens County) 1954. This species has been most recently recorded in 1963 from Genoa in Ottawa County by Carr, in 1977, 1984, and 1988 from the Lucas County Oak Openings area by Carr and J. A. Shuey, and in 1988 in Lynx Prairie in Adams County by D. J. Wright.

Discussion: This species has been collected most often in Michigan in old fields or disturbed habitats with sandy soils and sparse vegetation in open sandy areas. Four of the eight Ohio specimens are from the Oak Openings area. Most of the remaining open sandy soil areas in Ohio are in the Oak Openings area, and these are succumbing to developmental pressures. The larval hosts are probably various forbs.

Recommendations: The Oak Openings and Lynx Prairie management recommendations suggested for *Cycnia inopinatus* also apply to *G. oithona.* If it no longer occurs outside Lucas and Adams counties, its category should be changed to Threatened.

STATUS UNKNOWN

Sphinx drupiferarum J. E. Smith 1797 Sphingidae - Wild Cherry Sphinx

Historical Occurrence: *Sphinx drupiferarum,* uncommon throughout Ohio, has apparently undergone a decline since 1980. Although reported to be "common" in the Lucas County Oak Openings in the mid-to-late 1970's (Carr pers. comm.), only one specimen has been taken since then (2 July 1988, J. W. Peacock) despite several attempts to locate the species. The only other post-1980 records are from Guernsey County (10 July 1982) and Sandusky County (13 July 1985).

Discussion: Reasons for the apparent decline of this species in Ohio are unknown. The preferred larval foodplants, wild cherry and plum (*Prunus* spp.), hackberry (*Celtis occidentalis* L.), and lilac (*Syringa vulgaris* L.) are common in Ohio (Braun 1961). It has been reared by L. C. Koehn on wild cherry in Geauga County.

Recommendations: Further attempts to locate this species in Ohio, particularly in the Lucas County Oak Openings, should be made and the precise reasons for the decline of this species should be determined.

Lapara bombycoides Walker 1856 Sphingidae - Northern Pine Sphinx

Historical Occurrence: Two Ohio specimens of *Lapara bombycoides* are known [Cleveland Museum of Natural History (CMNH)]. Both were reared by H. Wormsbacher in 1920 (Dover, Tuscarawas County, 15 and 20 June). Data regarding foodplants, source of the larvae, and dates of pupation, etc., are lacking.

Discussion: The range of *Lapara bombycoides* extends along its eastern margin from Florida, north to Nova Scotia and New Brunswick, and along its western margin from Tennessee, Indiana, and Nebraska, north to British Columbia (Riotte 1972). Riotte and Hodges (1971) list white pine (*Pinus strobus* L.) as the preferred foodplant for larvae of this species. Additional hosts are *Pinus banksiana* Lamb., *P. resinosa* Ait., *P. rigida* Mill., *P. taeda* L. and *Larix laricina* (DuRoi) K. Koch. Of these, only *P. taeda* is not known from Ohio (Braun 1961). All others are either indigenous or planted in several of Ohio's State Parks or State Forests (Braun 1961).

This species may not occur naturally in Ohio. Wormsbacher may have reared this species from stock acquired in an exchange, or the species could have been accidentally introduced with host seedlings during reforestation efforts.

Recommendations: Collectors should search for this species where its preferred foodplant, white pine, occurs, particularly in northeastern Ohio.

Holomelina nigricans (Reakirt 1864) Arctiidae

Historical Occurrence: One specimen (Metzler collection) is from Vinton County, Ohio, Brown Township, Section 17, 22 May 1982.

Discussion: This record may represent a disjunct population, as nearly all specimens are from the New Jersey Pine Barrens (where it is most often found) or southeastern Pennsylvania. It is a rare and obscure species with spotty occurrence (Ferguson pers. comm.). The Vinton County site, at the corner of Irish Ridge Road and Long Ridge Road in Zaleski State Forest, is representative of a barrens habitat with scrubby pines and openings of bare soil in the oak forest.

Recommendations: Field surveys are needed to determine if this species is resident in Ohio. Forest management practices for this area should include provisions to maintain open areas preserving the barrens in Vinton County.

Species Of Special Interest

Samia cynthia (Drury 1773) Saturniidae - Ailanthus Silkmoth

Historical Occurrence: This species was introduced into Philadelphia, PA in the 1860's. It has spread north, west and south and today survives mostly in urban areas where it has been recorded most commonly near railroad yards supporting substantial stands of the food plant for larvae, Chinese tree-of-heaven, *Ailanthus altissima* (Mill.) Swingle (Ferguson 1971-72). Its survival in the United States was undoubtedly assisted by release of reared specimens as suggested by Pilate (1883) in referring to his releases in Dayton, OH: "I turned out some *cynthia* some years ago, and now the species is very common in our city." The only remains of the once common Dayton population is one undated Montgomery County specimen in the Dayton Museum of Natural History (DMNH). Only two other Ohio specimens have been located (CMNH) labeled "Dover, Ohio [Tuscawaras County], VI 10 - 22, H. Wormsbacher".

Although unreported, this species may occur in Ohio cities either from natural dispersal or releases. It flies during the day, apparently in central city areas, and may be overlooked by collectors. An effective way to find it is by looking for cocoons in the winter. If the relationship with railroad yards in central cities is correct (Ferguson 1971-72), it may decline by removal of these yards.

Sphinx luscitiosa Clemens 1859 Sphingidae - Clemens' Sphinx.

Historical Occurrence: This species is considered rare (Hodges 1971), and Ohio is the extreme southern edge of its range. Strecker (1876) was the first to record this species in Ohio. The only specimen with precise data (OSUC) was collected by Price (12 June 1957) in the Lucas County Oak Openings. It has also been recorded from eastern LaGrange County, IN (Winter 1979) and western Greene County, PA (Newcomer 1970). Larvae have been reared on willow (*Salix* sp.) (Newcomer 1970) and birches (*Betula* spp.) (Hodges 1971). It may still occur in extreme northern Ohio, but there are no recent Ohio records.

Aellopos fadus (Cramer 1776) Sphingidae - Fadus Sphinx

Historical Occurrence: Jared Potter Kirtland, the famous Ohio naturalist, established an anomaly in 1851 when he described *Macroglossa balteata*, now considered a synonym of *Aellopos fadus* (Cramer), from several specimens collected in Poland, OH. Described from specimens considered to be endemic to Ohio, this species is really a neotropical migrant (Hodges 1971).

There are few northern records for this species. *Aellopos fadus* is an emigrant which, under ideal conditions, may temporarily reside in Ohio. H. W. Godwin collected one specimen (July 1979) in a "mountain meadow" near Farmington, Marion County, WV, 35 miles ESE of Sardis, OH. It is possible this species utilizes the Ohio River as a flyway. There are no recent records from Ohio.

Xylophanes tersa (Linnaeus 1771) Sphingidae - Tersa Sphinx

Historical Occurrence: *Xylophanes tersa* has been collected regularly in Ohio for many years. The earliest records for the state are Clemens (1859), Dury (1878), Pilate (1882), and Henninger (1910). Recent captures have been made in all regions of Ohio from early June through late September.

This species is another southern resident that migrates to northern states. Given the ample number of records and the time span between the earliest and latest dates of capture, it is possible this species is an intermittent resident in Ohio. Larval foodplants are buttonplant (*Spermacoce glabra* Michx.), starclusters (*Pentas* sp.) and *Manettia* sp. (Hodges 1971). Tietz (1972) lists *Catalpa* sp., *Diodia teres* Walt., *Diospyros virginiana* L., *Rubiaceae* sp. and corn (*Zea mays* L.) as hosts for *X. tersa*. Several of these plants are common in Ohio (Braun 1961, Cusick & Silberhorn 1977, Weishaupt 1971). *X. tersa* may become a temporary resident in Ohio when conditions favor its survival. An effort should be made to find wild larvae in Ohio and to see if it is able to overwinter.

Notodonta simplaria Graef 1881 Notodontidae

Historical Occurrence: This species inhabits the Canadian and Transition life zones. It is considered rare (Forbes 1948), but may be locally common in Michigan. Ohio is the extreme southern edge of its range. Three specimens from Ashtabula County (10 July 1986) are in the J. D. Hooper collection, and five specimens from Ashtabula County (9 May 1987) are in the Lucas collection.

Gluphisia lintneri (Grote 1877) Notodontidae

Historical Occurrence: This rare species inhabits the Canadian and Transition Zones. Ohio is the extreme southern edge of its range. One specimen from Ashtabula County (18 April 1987) is in the Lucas collection.

Crambidia pura Barnes & McDunnough 1913 Arctiidae - Pure Lichen Moth

Historical Occurrence: Ohio is the extreme northwest edge of the range of this rare species (Ferguson pers. comm.). Two Ohio specimens are known. One specimen, Ohio University Collection (OUC), was taken in Athens, Athens County (12 Sept. 1931) by W. C. Stehr, and D. J. Wright collected one specimen at Lynx, Adams County (10 Sept. 1988).

Grammia doris (Boisduval 1869) Arctiidae - Doris Tiger Moth

Historical Occurrence: Ohio is the extreme edge of the range of this species. Pittsburgh, PA is the closest locality where it occurs with regularity. A single Ohio specimen (OUC) was collected in Athens (7 July 1931).

DISCUSSION

The bionomics, geographic ranges, and long-term changes in abundance of most species of moths are inadequately known, which makes categorizing them difficult. Although we adopted the scheme proposed by Shuey et al. (1987), our treatment of the moths prompted us to add a category, **Special Interest**, to include those species whose status did not fit other categories.

Of the 184 moth species in the seven Lepidoptera families evaluated, one is **Endangered**, *Cycnia inopinatus* (Arctiidae), and none are **Threatened**. Four species are of **Special Concern**: *Hemileuca maia* (Saturniidae), *Smerinthus cerisyi* and *Hemaris gracilis* (Sphingidae), and *Grammia oithona* (Arctiidae). All five species occur in habitats comprised of sandy soils, old fields with open sandy areas, and dry oak woods such as those found in the Oak Openings of Lucas County. The four species of **Special Concern** could become **Endangered** or **Threatened** with continued habitat losses in the Oak Openings or indifferent management practices in Lynx Prairie.

The **Status is Unknown** for three species: *Sphinx drupiferarum* and *Lapara bombycoides* (Sphingidae), and *Holomelina nigricans* (Arctiidae). Eight species are of **Special Interest**: *Samia cynthia* (Saturniidae), *Sphinx luscitiosa, Aellopos fadus* and *Xylophanes tersa* (Sphingidae), *Notodonta simplaria* and *Gluphisia lintneri*

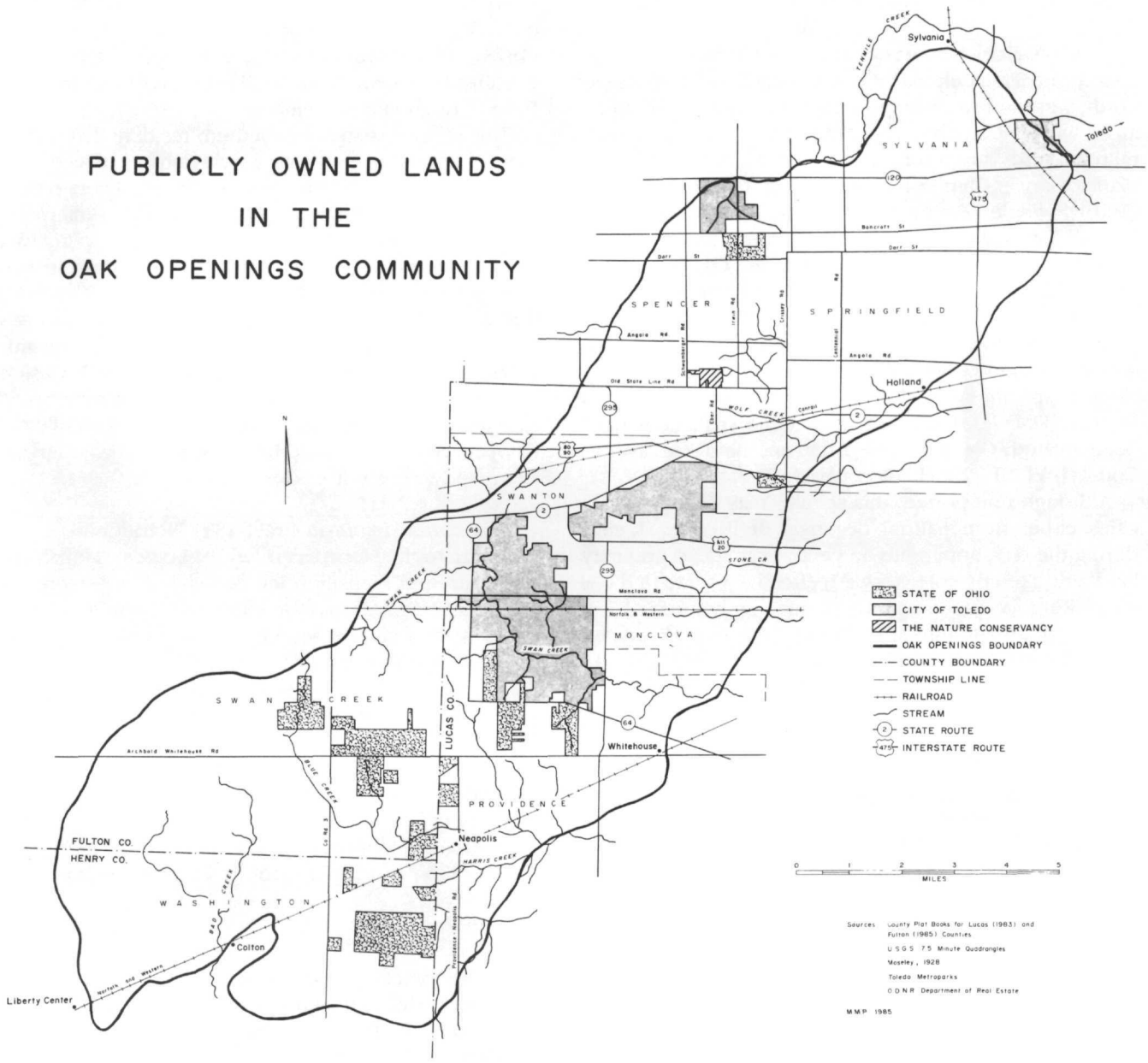

FIGURE 1. Publicly owned lands in the Oak Openings Community. Shaded areas indicate ownership according to the key. The map was drawn by Margaret Popovich for The Nature Conservancy, 1985.

TABLE 2

Land Use/Land Cover in the Oak Openings. The data were provided by the Remote Sensing Program of the Ohio Department of Natural Resources aerial photography. Fulton County is from Spring, 1985 and Lucas County is from May, 1986. Additional information is available from "Ohio Land Use/Cover Classification System" Misc. Report No. 17 available from the Ohio Department of Natural Resources.

	Lucas County		Fulton County		Totals	
	Acres	Percent	Acres	Percent	Acres	Percent
Modified land use with loss of natural habitat:						
Agriculture	16,796	31.91	7,717	58.43	24,513	37.23
Residential	10,197	19.37	1,188	8.99	11,385	17.29
Commercial/ Industrial	2,253	4.28	20	.15	2,273	3.45
Developed Greenspace*	689	1.31	12	.09	701	1.06
Miscellaneous	525	.99	0	0	525	.79
Totals	30,460	57.86	8,937	67.66	39,397	59.82
Undeveloped land with potential for natural habitats:						
Forest	12,719	24.86	2,856	21.63	15,575	23.65
Wetlands	4,865	9.24	544	4.12	5,409	8.21
Openspace/ Brushland	2,832	5.38	848	6.41	3,680	5.58
Rights-of-way	695	1.32	0	0	695	1.05
Other undeveloped	579	1.10	0	0	579	.88
Lakes	481	.91	21	.16	502	.76
Totals	22,171	42.81	4,269	32.32	26,440	40.13

* Developed Greenspace is greenspace areas no longer supporting natural habitats, i.e. cemeteries, golf courses and developed campgrounds.

(Notodontidae), and *Crambidia pura* and *Grammia doris* (Arctiidae). Reasons for designating these species of special interest are diverse. Little can be done to manage for these species, however we call attention to their occurrence in Ohio so others may watch for them. We recommend further research into the life histories of these species in Ohio to determine their local host plant and habitat requirements.

Shuey et al. (1987) identified two major threats to lepidopteran diversity in Ohio: uncontrolled plant succession in the Lucas County Oak Openings and chemical spraying for gypsy moth control. We also place special emphasis on the habitats of western Lucas County and the Oak Openings area. In addition to the moths cited here, three of Ohio's four endangered butterflies also occur in the Oak Openings. Developmental pressures and previously unabated succession by plant communities place these habitats in jeopardy.

Natural habitats no longer exist on sixty percent of the land in the Oak Openings (Table 2). Three opportunities exist to restore the Oak Openings habitat: 1) by acquiring more land for preservation; 2) by reclaiming agriculture land; and 3) by removing forest overstory. Recent efforts by the ODNR Division of Natural Areas and Preserves, The Metropolitan Park District of the Toledo Area, and The Nature Conservancy to purchase prime areas, to burn areas, and to create disturbances with open areas are encouraging. More of the property (Fig. 1) owned by public and quasi-public (i.e. The Nature Conservancy) agencies should be managed to enhance the unique characteristics of the Oak Openings.

Modern management practices for parks, preserves, and natural areas include habitat manipulation to enhance species diversity. It may be necessary to open areas with heavy equipment to retain the sand hills and old fields favored by these species. Other agencies, including the ODNR Division of Forestry, should adopt similar land management practices where feasible. The value of species diversity in the Oak Openings outweighs the value of trees lost, especially pine plantings, which can be replaced in adjacent areas of Ohio. The Oak Openings is too limited to be devoted to uses inconsistent with its natural condition.

Of particular concern is the potential use of insecticides or Dimilin for gypsy moth control in the state. We believe the application of insecticides, Dimilin, or other target non-specific chemicals can cause widescale destruction to non-pest species. Most pesticides are applied to agricultural or other specialized habitats which do not support a full array of native species. Damage to non-pest species occurs if the poison accidentally misses the target. Pesticides used for gypsy moth control, on the other hand, are purposely applied to natural forest habitats where it can be lethal to a great many species of arthropods in addition to gypsy moths. With the inevitable occurrence of gypsy moths in Ohio, we urge limited use of Dimilin and other pesticides to specific areas in a method that protects non-target species.

More intensive research is needed to fully understand the habitat requirements of most of these species in Ohio. The large number of amateur lepidopterists has much potential. Agencies should encourage efforts to collect specimens and perform other research on the lands under their jurisdiction. This seems especially true in the Oak Openings area of Lucas County.

ACKNOWLEDGEMENTS. We are indebted to The Ohio Department of Natural Resources Division of Wildlife for financial support of this research. We are equally indebted to curators of several institutional collections: Ohio Agricultural Research and Development Center, The Ohio State University, The Ohio Historical Society, Cleveland Museum of Natural History, Cincinnati Museum of Natural History, Dayton Museum of Natural History, Ohio University, Miami University of Ohio, Carnegie Museum of Natural History, American Museum of Natural History, U.S. National Museum, Field Museum of Natural History, University of Louisville, Youngstown State University, Heidelberg College, Wittenburg University, Alliance College, and holders of private collections too numerous to list for providing access to the specimens under their care. John G. Franclemont and Douglas C. Ferguson

provided valuable distributional data and larval host plant information. Roy W. Rings, John A. Shuey, David C. Iftner, John V. Calhoun and John W. Peacock also obtained data from some collections. James A. Toot was especially helpful to V. Lucas in collecting Sphingidae data. Others took the extra care to provide copies of data from their collections.

We give special credit to the members of The Ohio Lepidopterists for their support in all areas of this research. The manuscript benefited from the constructive comments of Roy W. Rings, John W. Peacock, John A. Shuey, David C. Iftner, John V. Calhoun, Denis Case, Richard A. Arnold, Paul A. Opler, Paul M. Tuskes, Steven M. Bonstedt, Ted Ford, and three anonymous reviewers.

The data for Table 2 were provided by Terry Wells, the Ohio Department of Natural Resources Division of Soil and Water Conservation. Figure 1 is a map drawn by Margaret Popovich for the Ohio Chapter of The Nature Conservancy. We thank both agencies for providing these materials.

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